

AMENDMENTS TO THE CLAIMS

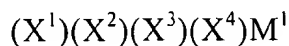
This listing of claims will replace all prior versions, and listings, of claims in the application. Please amend Claims 8, 26-39, 41-43, and 45 as indicated in the Listing of Claims. Please cancel Claims 46-49 without prejudice. Please add new Claims 50-54 as indicated in the Listing of Claims.

Listing of Claims

8. (Currently Amended) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising contacting said catalyst composition and at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising contacting at least one organometal compound, at least one treated solid oxide compound, and at least one organoaluminum compound to produce said catalyst composition,

wherein said organometal compound has the following general formula

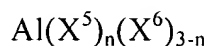


wherein M^1 is selected from ~~the group consisting of~~ titanium, zirconium, ~~and~~ or hafnium, and

wherein (X^1) is independently selected from ~~the group consisting of~~ cyclopentadienyls, indenyls, fluorenyls, substituted cyclopentadienyls, substituted indenyls, ~~and~~ or substituted fluorenyls, and

wherein substituents on said substituted cyclopentadienyls, substituted indenyls, and substituted fluorenyls are selected from ~~the group consisting of~~ aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, ~~and~~ organometallic groups, ~~and~~ or hydrogen; and

wherein (X³) and (X⁴) are independently selected from ~~the group consisting of~~ halides, aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, ~~and or~~ organometallic groups, and wherein (X²) is selected from ~~the group consisting of~~ cyclopentadienyls, indenyls, fluorenyls, substituted cyclopentadienyls, substituted indenyls, substituted fluorenyls, halides, aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, ~~and or~~ organometallic groups, and wherein said organoaluminum compound has the following general formula,



wherein (X⁵) is a hydrocarbyl having from 1-20 carbon atoms, and wherein (X⁶) is a halide, hydride, or alkoxide, and wherein "n" is a number from 1 to 3 inclusive; wherein said treated solid oxide compound is produced by a process comprising contacting at least one solid oxide compound with at least one electron-withdrawing anion source compound; and wherein said solid oxide compound is calcined before, during, or after contacting said electron-withdrawing anion source; and wherein the activity of said catalyst composition is greater than 250 grams of polyethylene per gram of treated solid oxide compound per hour; and wherein there is a substantial absence of aluminoxanes and organoborates.

26. (Currently Amended) A process according to Claim 8, wherein said polymerization conditions comprise slurry polymerization conditions.

27. (Currently Amended) A process according to Claim 26, wherein said contacting is conducted in a loop reactor zone.

28. (Currently Amended) A process according to Claim 27, wherein said contacting is conducted in the presence of a diluent that comprises, in major part, isobutane.

29. (Currently Amended) A process according to Claim 26, wherein said at least one monomer is ethylene.

30. (Currently Amended) A process according to Claim 26, wherein said at least one monomer comprises ethylene and an aliphatic 1-olefin having 3 to 20 carbon atoms per molecule.

31. (Currently Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising:

- 1) contacting said solid oxide compound with said at least one electron-withdrawing anion source compound to form a first mixture; and
- 2) calcining said first mixture to form said treated solid oxide compound.

32. (Currently Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising simultaneously calcining and contacting said solid oxide compound and said at least one electron-withdrawing anion source compound.

33. (Currently Amended) A process according to Claim 8, wherein said electron-withdrawing anion source compound is selected from ~~the group consisting of~~ sulfates, halides, and or triflate.

34. (Currently Amended) A process according to Claim 8, wherein said calcining is conducted for about 1 hour to about 10 hours at a temperature in the range of about 400°C to about 800° C.

35. (Currently Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising increasing the acidity of said solid oxide compound by two, or more, electron-withdrawing anion source compounds in two, or more, separate steps.

36. (Currently Amended) A process according to Claim 35, wherein said treated solid oxide compound is produced by a process comprising:

- 1) contacting said at least one solid oxide compound with a first electron-withdrawing anion source compound to form a first mixture;
- 2) calcining said first mixture to produce a calcined first mixture;
- 3) contacting said calcined first mixture with a second electron-withdrawing anion source compound to form a second mixture; and
- 4) calcining said second mixture to form said treated solid oxide compound.

37. (Currently Amended) A process according to Claim 8, wherein said catalyst composition is produced by a process comprising:

- 1) contacting said organometal compound and said treated solid oxide compound together for about 1 minute to about 1 hour at a temperature of about 25°C to about 100°C to form a first mixture; and
- 2) contacting said first mixture with an organoaluminum compound to form said catalyst composition.

38. (Currently Amended) A process according to Claim 8, wherein said catalyst composition can polymerize ethylene into a polymer with an activity greater than 2000 (gP/(gS·hr)), and

wherein said at least one organometal compound is selected from ~~the group consisting of~~

bis(cyclopentadienyl) hafnium dichloride;
bis(cyclopentadienyl) zirconium dichloride;
[ethyl(indenyl)₂] hafnium dichloride;
[ethyl(indenyl)₂] zirconium dichloride;
[ethyl(tetrahydroindenyl)₂] hafnium dichloride;
[ethyl(tetrahydroindenyl)₂] zirconium dichloride;
bis(n-butylcyclopentadienyl) hafnium dichloride;
bis(n-butylcyclopentadienyl) zirconium dichloride;
((dimethyl)(diindenyl)silane) zirconium dichloride;
((dimethyl)(diindenyl)silane) hafnium dichloride;
((dimethyl)(ditetrahydroindenyl)silane) zirconium
dichloride;
((dimethyl)(di(2-methyl indenyl)) silane) zirconium
dichloride;
bis(fluorenyl) zirconium dichloride; or mixtures thereof,
and

wherein said at least one organoaluminum compound is selected from ~~the group consisting of~~

trimethylaluminum;
triethylaluminum;
tripropylaluminum;
diethylaluminum ethoxide;
tributylaluminum;

triisobutylaluminum hydride;

triisobutylaluminum;

diethylaluminum chloride; or mixtures thereof, and

wherein said solid oxide compound is selected from ~~the group consisting of~~

Al_2O_3 , B_2O_3 , BeO , Bi_2O_3 , CdO , Co_3O_4 , Cr_2O_3 , CuO , Fe_2O_3 , Ga_2O_3 , La_2O_3 ,

Mn_2O_3 , MoO_3 , NiO , P_2O_5 , Sb_2O_5 , SiO_2 , SnO_2 , SrO , ThO_2 , TiO_2 , V_2O_5 , WO_3 ,

Y_2O_3 , ZnO , ZrO_2 ; and mixed oxides thereof, or mixtures thereof, and

wherein said treated solid oxide compound has been contacted with fluoride or chloride or both.

39. (Currently Amended) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising contacting said catalyst composition and said at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining alumina at about 600°C for about 3 hours and simultaneously contacting with carbon tetrachloride to produce a treated solid oxide compound;
- 2) combining said treated solid oxide compound with bis(n-butylcyclopentadienyl) zirconium chloride at a temperature in a range of about 25°C to about 100°C to produce a mixture; and
- 3) about between 1 minute and 1 hour, combining said mixture and triethylaluminum to produce said catalyst composition.

40. (Previously Presented) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising

contacting said catalyst composition and said at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining an oxide selected from alumina, silica-alumina, aluminophosphate, and mixtures thereof to produce a calcined oxide;
- 2) contacting said calcined oxide with a treating agent selected from sulfating agents, fluoriding agents, and chloriding agents to produce a treated oxide;
- 3) combining (1) said treated oxide, (2) an organoaluminum compound selected from triethylaluminum, triisobutylaluminum, and mixtures thereof; and (3) an organometal compound.

41. (Currently Amended) A process according to Claim 40, wherein said organometal compound is bis(n-butylcyclopentadienyl) zirconium dichloride.

42. (Currently Amended) A process according to Claim 41, wherein said treating agent is a chloriding agent.

43. (Currently Amended) A process according to Claim 42, wherein said treating agent is carbon tetrachloride.

44. (Previously Presented) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising contacting said catalyst composition and said at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining alumina to produce a calcined alumina;
- 2) treating said calcined alumina with carbon tetrachloride at an elevated temperature to give a treated alumina;
- 3) combining said treated alumina with triethylaluminum and bis(n-butylcyclopentadienyl) zirconium dichloride.

45. (Currently Amended) A process according to Claim 8, wherein said catalyst composition is produced by a process consisting essentially of contacting said organometal compound, said treated solid oxide compound, and said organoaluminum compound.

Claims 46-49. Cancelled.

50. (New) A process according to Claim 8, wherein said at least one organometal compound is selected from:

bis(cyclopentadienyl) hafnium dichloride;
bis(cyclopentadienyl) zirconium dichloride;
[ethyl(indenyl)₂] hafnium dichloride;
[ethyl(indenyl)₂] zirconium dichloride;
[ethyl(tetrahydroindenyl)₂] hafnium dichloride;
[ethyl(tetrahydroindenyl)₂] zirconium dichloride;
bis(n-butylcyclopentadienyl) hafnium dichloride;
bis(n-butylcyclopentadienyl) zirconium dichloride;
((dimethyl)(diindenyl)silane) zirconium dichloride;
((dimethyl)(diindenyl)silane) hafnium dichloride;
((dimethyl)(ditetrahydroindenyl)silane) zirconium
dichloride;

((dimethyl)(di(2-methyl indenyl)) silane) zirconium
dichloride;
bis(fluorenyl) zirconium dichloride; or mixtures thereof.

51. (New) A process according to Claim 8, wherein said at least one organoaluminum compound is selected from trimethylaluminum, triethylaluminum, tripropylaluminum, diethylaluminum ethoxide, tributylaluminum, triisobutylaluminum hydride, triisobutylaluminum, diethylaluminum chloride, or mixtures thereof.

52. (New) A process according to Claim 8, wherein said at least one solid oxide compound is selected from Al_2O_3 , B_2O_3 , BeO , Bi_2O_3 , CdO , Co_3O_4 , Cr_2O_3 , CuO , Fe_2O_3 , Ga_2O_3 , La_2O_3 , Mn_2O_3 , MoO_3 , NiO , P_2O_5 , Sb_2O_5 , SiO_2 , SnO_2 , SrO , ThO_2 , TiO_2 , V_2O_5 , WO_3 , Y_2O_3 , ZnO , ZrO_2 , mixed oxides thereof, or mixtures thereof.

53. (New) A process according to Claim 52, wherein said at least one solid oxide compound is selected from silica-alumina or silica-zirconia.

54. (New) A process according to Claim 38, wherein said at least one solid oxide compound is selected from silica-alumina or silica-zirconia.